

## How Might the Fed's Large-Scale Asset Purchases Lower Long-Term Interest Rates?

*By Renee Courtois Haltom and Juan Carlos Hatchondo*

**Over the past two years the Federal Reserve has engaged in large-scale asset purchases (LSAPs), often grouped under the heading of “quantitative easing,” as an alternative means of stimulating the economy when policy rates are at their zero lower bound. Theoretical and empirical research shows how this policy may lower long-term interest rates, and financial market data suggest that the initial launch of LSAPs had an effect on expectations about future Fed policy.**

For many years economists have theorized about the options for stimulating the economy with monetary policy when policy rates are pushed as low as they can go. Until recently this was little more than a hypothetical exercise in the United States, spurred in part by Japan's encounter with the so-called “zero lower bound” on interest rates in the 1990s. The question also bore some operational importance. “The greater the confidence of central bankers that tools exist to help the economy escape the zero bound, the less need there is to maintain an inflation ‘buffer,’ bolstering the argument for a lower inflation objective,” wrote Federal Reserve chairman Ben Bernanke, then a governor, with economists Vincent Reinhart and Brian Sack in 2004.<sup>1</sup>

Today the Federal Reserve is itself facing the zero bound on interest rates, as are many central banks globally. Since December 2008, the Fed's primary policy interest rate, the target federal funds rate, has been set at a range of between zero and 0.25 percent. Nonetheless, the economy has remained weak. Several Fed policymakers have expressed that if it were possible to push the federal funds rate lower,

they would currently support doing so to stimulate the economy.

What options do policymakers have when further accommodation is desired but policy interest rates cannot be cut any further? One option is to take steps to influence interest rates in the economy through nontraditional avenues. Under normal circumstances (i.e., when interest rates are not at the zero bound) the Fed stimulates the economy by purchasing Treasury securities through open market operations. This increases the quantity of reserves in the banking system and puts direct downward pressure on the federal funds rate, the market-determined rate at which banks lend to each other on an overnight basis. As banks' borrowing costs are bid down, so are other lending rates in the economy.

Through a similar mechanism, the Fed can also put downward pressure on market interest rates by purchasing large quantities of assets from the private sector. This is often referred to as “quantitative easing” or “large-scale asset purchases” (LSAPs).<sup>2</sup> The Fed has launched LSAPs programs on two separate occasions in recent history.

From November 2008 to March 2010 the Fed purchased \$1.75 trillion in long-term treasuries and both debt and fixed rate mortgage-backed securities issued by Fannie Mae and Freddie Mac. In November 2010 the Fed announced that it would purchase an additional \$600 billion in long-term treasuries by the middle of 2011, or about \$75 billion each month.

Before the recent financial crisis, open market operations were designed to not have a large effect on Treasury prices; such purchases used to be small relative to the total markets of the securities involved. In contrast, LSAPs are designed specifically to be large enough to have an effect on Treasury prices and yields. The first round of LSAPs represented 22 percent of the \$7.7 trillion stock of those assets outstanding at the beginning of the program, estimate New York Fed researchers Gagnon, Raskin, Remache, and Sack (2010).<sup>3</sup> They suggest that no investor, public or private, has ever made such large purchases in such a short period of time.

### **The Portfolio Rebalance Channel**

How precisely do LSAPs affect long-term interest rates? The direct effect is to reduce the supply of longer-term investments held by the public, replacing that supply with reserves. Investors react by rebalancing their portfolios of bonds and other investments, though that does not necessarily mean that a change in the supply of long-term bonds should have a noticeable effect on long-term rates since assets of different maturities are to a degree substitutable to investors.

Indeed, early research did not find empirical support for the idea that the government's choice of the "maturity structure" of government debt—the proportion of total government debt issued in short-term versus long-term bonds—would strongly affect the prices and yields on those debt instruments. A study by Modigliani and Sutch in 1966 looked at the effect of a U.S. Treasury effort to raise short-term rates in the early 1960's through open market purchases by the Fed.<sup>4</sup> The purpose of this effort was to boost the dollar and capital inflows to the United States. They found little movement in short-term Treasury yields, although later studies noted concurrent

actions by the Treasury that potentially offset the program.

Studies on subsequent episodes in which the relative supply of long-versus short-term treasuries was affected have found a stronger effect of the maturity structure of government debt on interest rates.<sup>5</sup> These results suggest that otherwise similar assets of different maturities are imperfect substitutes. If different market participants display a strong preference for different maturity dates, a reduction in the supply of long-term treasuries would turn them into a more scarce good, and thus would make them trade at a higher price and, equivalently, lower their yield. The "preferred habitat" hypothesis was a channel often cited as a possible explanation for the imperfect substitutability between long-term treasuries and other assets. This hypothesis was introduced by Modigliani and Sutch in 1966, but no formal model was provided, which did not allow for progress in studying its implications.

The gap has been partially filled by a 2009 paper by Vayanos and Vila.<sup>6</sup> They provide the first formal model of the preferred habitat view of the term structure of interest rates. They model two types of investors: A set interested only in assets of a specific maturity, and arbitrageurs with no strong preference for any specific maturity. As a representative example of an investor with a strong preference for assets with a specific maturity, think, for instance, of a 50-year-old worker who may prefer saving in treasuries with a maturity of 20 years versus investing in shorter-term treasuries and rolling them over upon maturity. The second investment strategy implies bearing the risk of interest rate changes. This may make it a riskier strategy if the worker assigns a low probability to having to sell those long-term treasuries before they mature, or if he assigns a low probability to an increase in inflation over the next 20 years.

In the setup presented by Vayanos and Vila, there is a potential role for LSAPs as long as arbitrageurs, who do not have any strong preference for any maturity date, are sufficiently risk averse. Another reason that has been mentioned for imperfect arbitrage is that the agents who could potentially

arbitrage away differences in returns between assets face leverage constraints.

But the preferred habitat hypothesis is not the only reason why LSAPs may have an effect on long-term interest rates. By purchasing long-term treasuries, the Fed is also removing duration, or interest rate risk, from the bond portfolio of the private sector. Interest rate risk is the risk that rates will rise over the life of a long-term bond, causing the price of the bond to fall and reducing the investor's return. Since the private sector as a whole is less exposed to interest rate risk, it will require lower marginal compensation for that risk. This would provide another source of downward pressure on long-term interest rates as a result of LSAPs.

However, this latter point is not complete, as pointed out by Minneapolis Fed president Narayana Kocherlakota.<sup>7</sup> The private sector is less exposed to interest rate risk because the public sector, through the Fed, has taken on that risk. From this perspective, the Fed's purchases have not eliminated interest rate risk faced by the economy, but only shifted it from bondholders to taxpayers. Given that private bondholders are also public taxpayers, LSAPs to an extent simply shift risk from one pocket to the other. To assume that the net effect is a boost in macroeconomic activity assumes that these effects do not cancel each other out—as would be the case, for example, if Ricardian equivalence is violated. (The theory of Ricardian equivalence predicts that extra tax risk will deter economic activity because taxpayers will save in anticipation of those potential future tax increases.)

### **The Communications Channel**

The LSAPs may also affect long-term interest rates through market expectations if they transmit information about the likelihood that the Fed will maintain the policy rate at a low level for a long period.

Since the end of 2008, the Fed has included in its policy statements an explicit commitment to keeping the federal funds rate at a very low level for “an extended period.” But accompanying such statements with an asset purchase program could be interpreted

as a stronger signal for low future interest rates. Since long term rates are a partial function of short term rates, long-term rates would tend to decline as well. (The LSAPs may also communicate information about the Fed's view of the weakness of the economy, which could reinforce weak private forecasts of future economic activity and therefore raise the probability that investors assign to low future interest rates.)

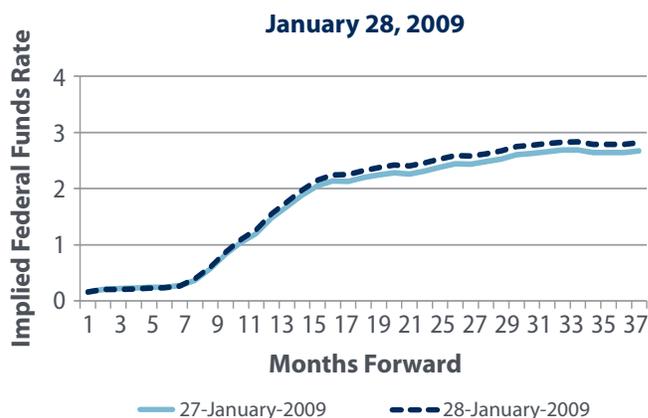
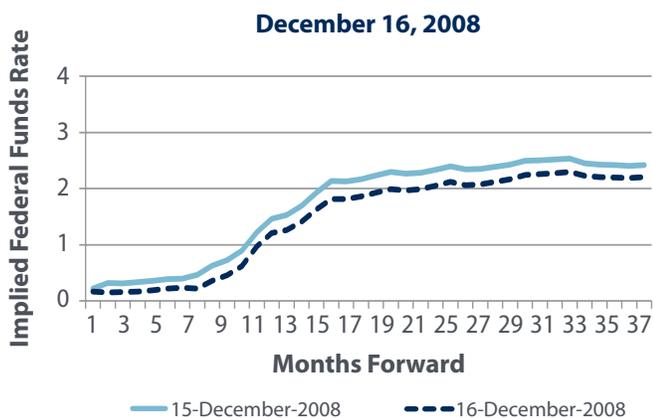
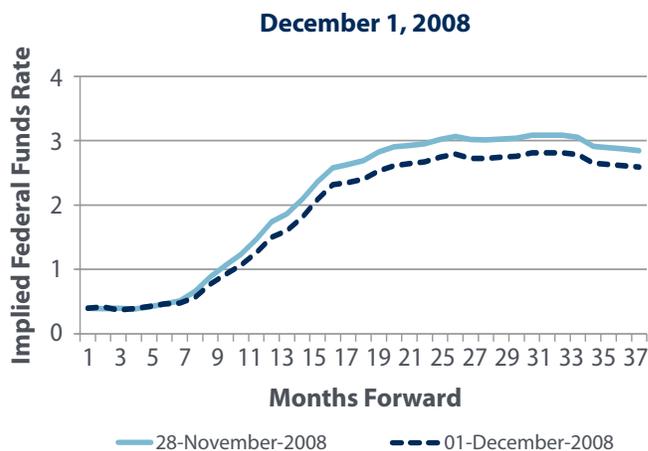
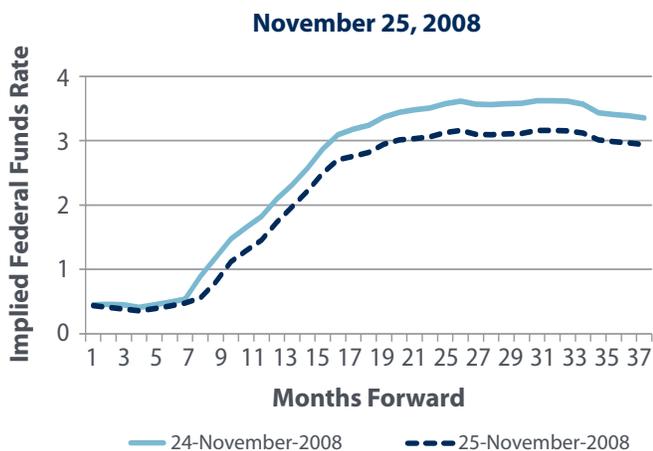
It is not easy to estimate the effect of a policy action on the probability distribution that market participants assign to possible paths of future short-term interest rates because that probability distribution is not directly observable. However, one can examine the prices of assets that are directly affected by changes in that probability distribution—namely, the prices of futures on federal funds rates.

There is strong evidence that near-term futures markets (that is, up to 3 months ahead) are a good predictor of the actual federal funds rate.<sup>8</sup> However, the rates implied by futures contracts with longer horizons are poor predictors of the actual rate. Among other studies, studies by Piazzesi and Swanson (2008)<sup>9</sup> and Hamilton and Okimoto (2010)<sup>10</sup> document that there is a non-negligible and time-varying “risk premium” component in long-horizon fed funds futures contracts that causes the rate markets expect to differ from the actual rate that transpires.<sup>11</sup> Piazzesi and Swanson (2008) show how introducing risk adjustments to the rates implied by futures contracts may deliver better predictions of actual federal funds rates.

Thus, one should exercise caution when using futures contracts to infer investors' expectations about future federal funds rates. Still, as long as the risk premium is not too volatile, changes in the federal funds rate implied by futures contracts would be informative about movements in the expectations of the future path of the federal funds rate. In particular, it could be that a relatively slow-moving term such as the cyclical variation in risk premia would have a small effect on day-to-day changes in futures prices.

We look at the affect of LSAPs on expectations as manifested through fed funds futures markets.

**Figure 1: Implied Federal Funds Rate Day Before and Day of Select Asset Purchase Announcements**



**Announcements**

**November 25, 2008:** Initial LSAPs announcement of up to \$100 billion in agency debt and up to \$500 billion in agency mortgage-backed securities (MBS).

**December 1, 2008:** Speech by Chairman Bernanke that the Fed “could purchase longer-term Treasury securities.”

**December 16, 2008 and January 28, 2009:** FOMC statements that the Fed was considering expanding agency purchases and initiating purchases of long-term Treasuries.

**March 18, 2009:** FOMC statement that the Fed would expand purchases up to \$300 billion of long-term Treasuries and up to \$200 billion and \$1.25 trillion of agency debt and agency MBS.

Note: Dates displayed here are considered by Gagnon et. al. (2010). Here we include in the implied federal funds rate a correction for term premium equal to one basis point per month. The January 28, 2009 change in fed funds futures is opposite of the sign expected; we don't have a full understanding of this at the present time.  
Source: Federal Reserve Board of Governors

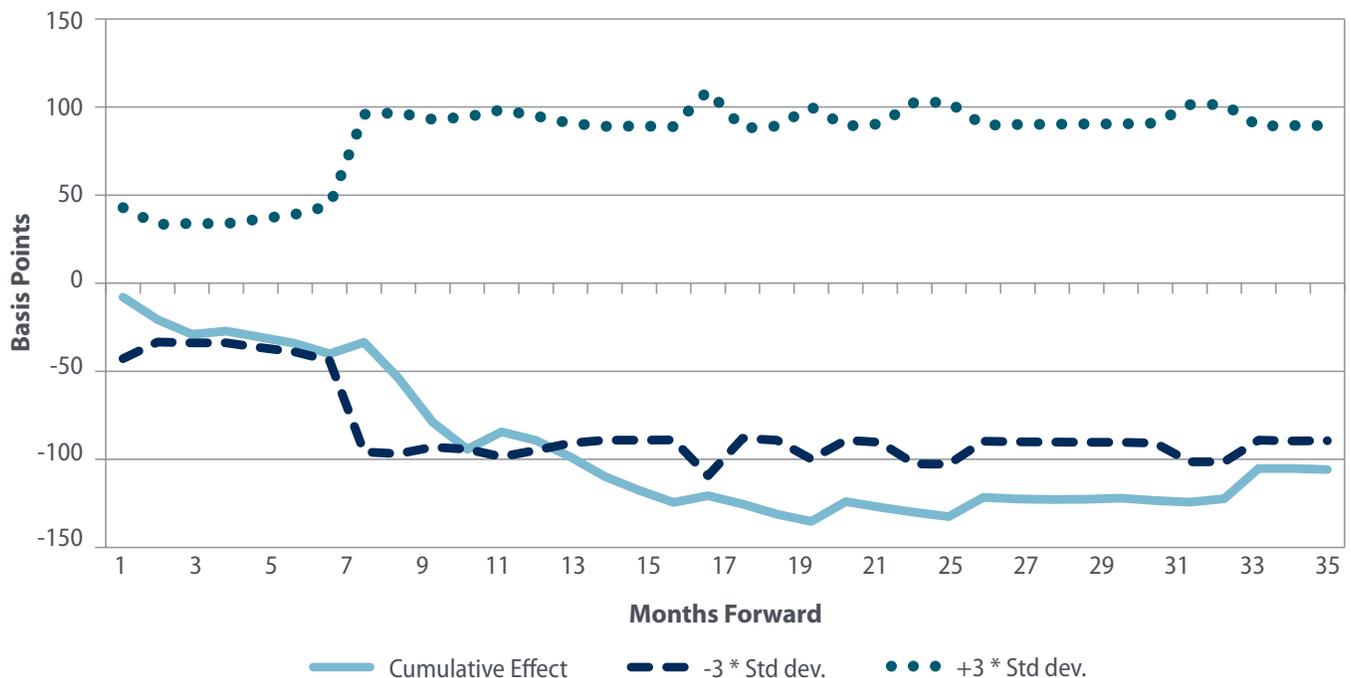
The technique we use is somewhat modeled from the aforementioned study by Gagnon et. al. (2010). They compare the closing value of Treasury and other bond yields in the days of relevant announcements about asset purchase programs and the closing value in the previous day. They consider eight announcement episodes, including the initial announcement of LSAPs, speeches on the policy by Fed officials, and announcements of changes to the policy. The authors find that in those eight days the yield on 10-year Treasury bonds accumulated a cumulative decline of 91 basis points. There were similar declines in agency debt and agency mortgage-backed securities. They also observed declines in yields on assets not directly purchased by the Fed, implying that the program to a degree achieved its intended effect on overall market interest rates.

Figure 1 shows how the implied rates in futures contracts changed in the earliest of those eight announcements, in which implied rates displayed the largest response. The implied rates decreased

significantly after the first announcements. For instance, the magnitudes of the falls in the implied rates with horizons of two and three years ahead that were observed after the first three announcements were more than three standard deviations away, compared to the average volatility of the daily change in those series since the start of 2008.

Figure 2 plots the cumulative decline over all eight announcements considered by Gagnon et. al., along with that standard deviation. These movements could be caused by a downward revision in the path of future federal funds rates expected by market participants. But these movements could also be caused by changes in risk premia for at least two reasons. First, removing duration from the portfolio of private agents in a period with low interest rates is likely to reduce the hedging demand of holders of long-term bonds that are concerned with capital losses caused by future increases in federal funds rates. That would tend to push the implied rates in futures contracts downward.

**Figure 2: Cumulative Response of Fed Fund Futures Markets to LSAPs Announcements**



Note: The solid line illustrates the cumulative change of implied rates in futures contracts over the eight LSAPs announcement days considered in Gagnon et. al. (2010). The dotted and dashed lines were computed based on the standard deviation of daily changes since the start of 2008, with the assumption that the movements in the implied rates observed in the announcement days were independent across each other.  
Source: Federal Reserve Board of Governors.

Second, one would expect that policy announcements would reduce uncertainty and, thus, would tend to reduce risk premia. Piazzesi and Swanson (2008) illustrate that the risk premium embedded in fed funds futures contracts is positive and relatively high during recessions, which suggests that a decrease in uncertainty may decrease the implied rates in futures contracts. Teasing out how much of the decline in the rates implied by futures contracts may be due to lower expectations of future federal funds rates or to lower risk premia is hard without a formal model that accounts for risk premia. In any case, one could conclude that the decline in the rates implied by futures contracts offers a measure of the upper bound of the effect of LSAP policy announcements on expectations of future federal funds rates.

### Conclusion

Empirical studies have found an effect of LSAPs on long-term interest rates, which could be reconciled with different theoretical explanations. However, one has to bear in mind that studies of the Fed's first round of LSAPs from late 2008 to early 2010 analyze an episode that was implemented at a time of considerable strain in financial markets. Many of those strains have receded today, so the magnitude of the effects reported in those studies cannot be extrapolated to estimate the expected effects of the current ongoing round of LSAPs.

There is some evidence that LSAPs have affected expectations about future Fed policy. In particular, there seems to be evidence of a downward revision in the expected future path of the federal funds rate during the first round LSAPs, though the magnitude of this effect is hard to decipher because of the likely simultaneous changes in risk premia. ■

Renee Courtois Haltom is a writer and Juan Carlos Hatchondo is an economist in the Research Department at the Federal Reserve Bank of Richmond.

### Endnotes

<sup>1</sup> Ben Bernanke, Vincent Reinhart, and Brian Sack, "Monetary Policy Alternatives at the Zero Bound: An Empirical Assessment," *Federal Reserve Board of Governors Finance and Economics Discussion Series*, September 9, 2004.

<sup>2</sup> The phrase "quantitative easing" has traditionally referred to efforts by the central bank to increase the supply of reserves in the banking system, though recently it has been applied more generally to refer to the Fed's recent asset purchases.

<sup>3</sup> Joseph Gagnon, Matthew Raskin, Julie Remache, and Brian Sack, "Large Scale Asset Purchases by the Federal Reserve: Did They Work?" *Federal Reserve Bank of New York Staff Reports*, March 2010.

<sup>4</sup> Franco Modigliani and Richard Sutch, "Innovations in Interest Rate Policy," *American Economic Review*, March 1966, pp. 178–197.

<sup>5</sup> For a summary, see Bernanke, Reinhart, and Sack (2004).

<sup>6</sup> Dimitri Vayanos and Jean-Luc Vila, "A Preferred-Habitat Model of the Term Structure of Interest Rates," NBER working paper, November 2009.

<sup>7</sup> Narayana Kocherlakota, "The Tools of the FOMC," speech given to Fargo area business leaders in Fargo, North Dakota on October 19, 2010.

<sup>8</sup> For example, see a 2009 study by James Hamilton titled, "Daily Changes in Fed Funds Futures Prices," *Journal of Money, Credit, and Banking*, June 2009, pp. 567–582.

<sup>9</sup> See Monika Piazzesi and Eric Swanson, "Futures Prices as Risk-Adjusted Forecasts of Monetary Policy," *Journal of Monetary Economics*, May 2008, pp. 677–691.

<sup>10</sup> James Hamilton and Tatsuyoshi Okimoto, "Sources of Variation in Holding Returns for Fed Funds Futures Contracts," forthcoming in *Journal of Futures Markets*.

<sup>11</sup> The systematic differences between the rates implied by futures contracts and realized values could be due to risk aversion or to other features such as informational frictions. For instance, in a 2010 manuscript titled "Asset Trading and Valuation with Uncertain Exposure," Hatchondo, Krusell, and Schneider show how aggregate biases in beliefs could appear in setups with asymmetric information. These biases could be misinterpreted as a risk premium. For simplicity, we follow Piazzesi and Swanson (2008) and use the term "risk premium" to refer to the deviation between rates implied by the futures contracts and actual federal funds rates.

This article may be photocopied or reprinted in its entirety. Please credit the authors, source, and the Federal Reserve Bank of Richmond, and include the italicized statement below.

*The views expressed in this article are those of the authors and not necessarily those of the Federal Reserve Bank of Richmond or the Federal Reserve System.*



THE FEDERAL RESERVE BANK OF RICHMOND  
RICHMOND ■ BALTIMORE ■ CHARLOTTE